

COMMENTARY

LIFE ON MARS – A REPLY

In his thoughtful review of my book, *To Utopia and Back: The Search for Life in the Solar System*, Richard S. Young (1987) raises two objections to my conclusion that life does not exist on Mars. Both, I believe, are based on misconceptions. I appreciate the opportunity to comment on them here.

The first rests on the discovery (Friedmann, 1982) that in the dry Antarctic desert, where microbial life in the soil is sparse or even absent, dense growths of lichens and bacteria can be found in a narrow zone a few millimeters beneath the north-facing surfaces of translucent, porous rocks. This phenomenon, Friedmann showed, is explained by the fact that the rocks are warmed sufficiently by the sun to melt snow, which is then absorbed by the rock; a sheltered, moist environment is thus created for microbial life.

In his review, Young argues that such endolithic habitats may exist also on Mars. It is not easy, however, to transfer the Antarctic scenario to Mars. The difficulty is the same one that stands in the way of all efforts to find a biological habitat on that planet: snow cannot melt, and liquid water cannot exist, on the surface of Mars, owing to the low pressure, high CO₂, and low water content of its atmosphere. In this respect, and in many others, there is no resemblance between Mars and the Antarctic desert. The latter is incomparably more favorable as a habitat. It is within but a few miles of the ocean, to name another major difference. At its worst, the Antarctic desert is just marginally unfit for life. Even in the driest areas, only 10 to 15% of soil samples are actually sterile. In such a place, a small climatic variation like the one that gives rise to the endolithic habitats can make the difference between a livable environment and a non-livable one. This would not be the case on Mars.

Although the Antarctic desert is not truly Marslike, we learned an important lesson in planetary biology there; namely, that the range of biological adaptability is very limited where the need for water is concerned. The discovery of sterile and nearly sterile soils in this desert, which has been exposed for tens of thousands of years to a constant airborne influx of contaminants and genetic variants from a vast pool of microbial life outside the area, was a revelation. It demonstrated in the clearest possible way the importance of water for life, and it caused some of us to begin to wonder whether it was reasonable to expect to find life on a planet as dry as Mars.

It is perhaps worth pointing out here that the question of endolithic habitats on Mars is one that can be approached experimentally. Enough is now known about the Martian environment to perform meaningful laboratory tests of this question. For any who are not satisfied by theoretical arguments, the experimental way is open.

Young's second objection to my conclusion that Mars is lifeless rests on the fact that there have been only two landings on Mars. He considers this an inadequate base for such large conclusions.

While it is true that we made just two landings on Mars, it is not true that our conclusions about life on Mars are based on just these landings. From 1963, the year the modern study of Mars began, until the Viking mission in 1976, Mars was the most intensively investigated of planets. It was studied from observatories on Earth and from flyby and orbiting spacecraft. The conclusion that Mars is lifeless is drawn not from the Viking findings at two sites, but from the global picture of Mars yielded by all the observations that have been carried out since 1963. To many, the evidence against life on Mars was very strong even before the Viking landings. When the landings finally came, they simply confirmed what already seemed highly likely. The confirmation, at two widely separated sites, was unequivocal: a waterless and chemically reactive Mars, lacking even a trace of organic matter.

I agree with Young that much work remains to be done on Mars, but I do not agree that that work includes a continued search for extant Martian life.

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References

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Young, R. S.: 1987, *Origins of Life* **17**, 213–215.